

The Monetary Aggregates:

An Introduction to Definitional Issues

THREE years ago the Board of Governors of the Federal Reserve System redefined the monetary aggregates—the measures of the stock of money in the economy. Since then the meaning of the new aggregates has been altered and their analytical usefulness has been reduced by developments similar to those that prompted the 1980 redefinition. Prominent among these developments is the appearance of new or substantially altered financial instruments and services. As a result, another redefinition of the aggregates may be needed, and it has even been suggested that the use of the aggregates as intermediate targets in monetary policy may have to be abandoned.

This article draws on research conducted, in the main, by Federal Reserve economists over the past few years, to provide an introduction to the issues involved in the definition of the monetary aggregates. The first section describes the factors that prompted the 1980 redefinition and the changes that were made. The second section focuses on the behavior of the aggregates since 1979 and on the major forces that may prompt future modifications of the monetary aggregates.

Aggregates, Old and New

Official estimates of the monetary aggregates are of rather recent origin. Until 1960, Federal Reserve statistics did not include a series labeled "money" or "money stock." For the next decade, the statistical pages of the *Federal Reserve Bulletin* reported only one such series—currency plus demand (checking) deposits.

During the 1970's increasing emphasis began to be placed on the role of the money stock in the implemen-

tation of monetary policy. It was not clear, however, that currency plus demand deposits was the most useful measure of the money stock. This total, or aggregate, did represent transactions balances, or the medium of exchange, which clearly belonged in any measure of the money stock. A considerable amount of research, however, suggested that the volume of "near-monies"—close substitutes for transactions balances—was also an important determinant of economic activity and, therefore, should be included in measures of the money stock. Unfortunately, there was (and is) no consensus on which, if any, assets besides transactions balances belong in a total called "money." A number of different totals, therefore, were developed in the early and middle 1970's.

Currency plus demand deposits was designated M1 early in 1971 and two new measures of money were introduced. M2 was defined as M1 plus savings and small-denomination time deposits at commercial banks; M3 was defined as M2 plus deposits at savings and loan associations, mutual savings banks and, later, credit unions.¹ Large negotiable certificates of deposit (CD's) were brought into this scheme in 1975: M4 and M5 were defined as large CD's plus M2, and large CD's plus M3, respectively. These five series were the monetary aggregates that the Federal Reserve Board overhauled in 1980.

Even before this classification scheme was completed, the Board launched a thorough investigation into its shortcomings and possible improvements. This investigation was

prompted in large part by two developments. First, new financial assets were developed in the early and middle 1970's; it was necessary to see if and how these should be reflected in the aggregates. Second, the demand functions for the aggregates showed a pronounced shift at about the same time that the new assets were appearing. This shift was important because it raised questions about the predictability of the effects of monetary policy. In fact, stability of demand is one of the criteria widely used for choosing the monetary aggregate on which to focus. (Another criterion sometimes used is the performance of the aggregates in reduced-form equations relating some important macroeconomic variable, such as GNP, on the one hand, to the aggregate and a fiscal policy variable, on the other.) The first part of the following section begins the discussion of these developments.

Shortcomings in the old aggregates

New financial assets.—Several new types of financial assets were created in the early and mid-1970's. Because these assets possessed some of the characteristics of assets that were included in one or more of the aggregates, the question arose as to whether the new assets should be included in the aggregates and, if so, in which ones. At first, of course, these new assets were quantitatively insignificant; including them in—or excluding them from—the aggregates made little practical difference. It quickly became obvious, however, that these assets would eventually reach sizable proportions, and the question would have to be addressed.

NOW accounts were the first of these new assets. In June 1972, the Massachusetts Supreme Judicial

1. Small-denomination, or simply "small," time deposits are those in denominations of less than \$100,000. Large-denomination, or "large," time deposits are those in denominations of \$100,000 or more.

Court ruled that there were no statutory restrictions on the way that withdrawals could be made from savings accounts at State-chartered mutual savings banks. Savings banks in the State soon began issuing savings deposits from which the owner could withdraw funds by writing a negotiable order of withdrawal—hence the acronym. The withdrawal document was a negotiable draft (like a check drawn on a demand deposit at a commercial bank), which could be used to make payments to third parties.

State-chartered savings banks in New Hampshire started offering NOW accounts within a few months of their introduction in Massachusetts. Federally regulated institutions in the two States were immediately at a competitive disadvantage because, like federally regulated institutions in the rest of the country, they were barred from offering NOW accounts. This disadvantage was subsequently removed by Federal legislation (PL 93-100) and amendments to the relevant Federal regulations; effective January 1, 1974, all depository institutions (except credit unions) in Massachusetts and New Hampshire were authorized to offer NOW accounts. By early 1976, Federal legislation authorizing NOW accounts in the rest of the New England States had become effective. These developments, and others related to the emergence of savings-based transactions accounts, are summarized in table 1.

NOW accounts have two important features. First, accounts at savings and loan associations and at savings banks could be used by depositors to pay third parties. The development of NOW accounts, therefore, signaled the end of the virtual monopoly over transactions accounts that commercial banks had previously enjoyed. Second, because the NOW accounts were technically classed as savings accounts, they could earn interest, unlike demand deposits, on which payment of interest was prohibited by the Banking Act of 1933.

Table 2 highlights the difficulty of adequately reflecting NOW accounts in the set of monetary aggregates that existed in the mid-1970's. Old-M1—defined as currency plus demand deposits at commercial banks—was designed to measure transactions balances, and, as a means of making

third-party payments, NOW accounts constituted transactions balances. Because NOW accounts were savings accounts, however, they were not included in this aggregate. Old-M2 included some, but not all NOW accounts. NOW accounts at commercial

banks entered the aggregates at this point, but NOW accounts at savings and loan associations and at mutual savings banks entered at the level of old-M3. Old-M3, which included time as well as savings deposits at all depository institutions, was clearly

Table 1.—The Development of Savings-Based Transactions Accounts

1970: September.....	The Federal Home Loan Bank Board permitted federally chartered savings and loan associations to make preauthorized nonnegotiable transfers from savings accounts to third parties for household-related expenditures.
1972: June.....	State-chartered mutual savings banks in Massachusetts began offering NOW accounts.
September.....	State-chartered mutual savings banks in New Hampshire began offering NOW accounts.
1974: January.....	Federal legislation authorized all depository institutions (except credit unions) in Massachusetts and New Hampshire to offer NOW accounts.
January.....	First Federal Savings and Loan of Lincoln, Nebraska, installed communications terminals in two supermarkets, enabling customers to withdraw funds from their savings accounts to pay for merchandise purchased from the stores.
August.....	The National Credit Union Administration permitted Federal credit unions to issue share drafts.
1975: April.....	The Federal Home Loan Bank Board permitted federally chartered savings and loan associations to make preauthorized transfers from savings accounts to third parties for any purpose.
September.....	Commercial banks were permitted to make preauthorized nonnegotiable transfers from savings accounts to third parties for any purpose.
November.....	Commercial banks were authorized to accept savings deposits from partnerships and corporations operated for profit, up to a limit of \$150,000 per customer per bank.
1976: February.....	Federal legislation extended NOW account authority to all New England States.
1978: October.....	Federal legislation extended NOW account authority to all New York State.
November.....	Commercial banks were authorized to offer automatic transfers from savings deposits to demand deposits.
1979: March.....	U.S. Court of Appeals ruled that automatic transfer accounts were illegal.
1980: March.....	Federal legislation extended NOW account authority nationwide (effective December 31, 1980) and legalized automatic transfer accounts.

Source: Steven M. Roberts, "Developing Money Substitutes: Current Trends and Their Implications for Redefining the Monetary Aggregates," in *Improving the Monetary Aggregates: Staff Papers* (Washington, D.C.: Board of Governors of the Federal Reserve System, November 1978). (Updated by author.)

Table 2.—Components of the Old Monetary Aggregates

Component	M1	M2	M3	M4	M5
Currency.....	X	X	X	X	X
Demand deposits at commercial banks.....	X	X	X	X	X
Savings balances at commercial banks.....		X	X	X	X
Time deposits at commercial banks.....		X	X	X	X
Savings balances at thrift institutions.....			X		X
Time deposits at thrift institutions.....			X		X
Negotiable certificates of deposit at large commercial banks.....				X	X

1. Except negotiable certificates of deposit at large commercial banks.

rather far from a measure of transactions balances.

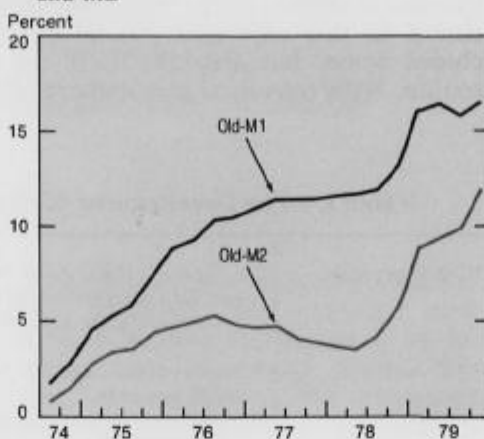
NOW accounts were only one of the innovations in financial markets at this time: Preauthorized transfers, telephone transfers, and automatic transfer from savings (ATS) blurred the line between savings accounts and transactions balances at commercial banks, i.e., between old-M1 and old-M2. Further, credit union share draft accounts and demand deposit accounts offered by some mutual savings banks began to reach significant proportions. The share draft accounts, which are transactions balances, entered the old set of aggregates at the M3 level. The demand deposit accounts did not fit neatly into any of the old-M's and, in fact, were not included in any.

In addition to new types of accounts at depository institutions, other new assets gained prominence in the mid-1970's. During 1974, the number of money market mutual funds rose from 4 to 30, and their net assets climbed from less than \$200 million to \$2½ billion. Most to these funds provided limited check-writing privileges, but because the funds are not classified as depository institutions, shares in the funds were not included in any of the old-M's.²

Overnight repurchase agreements (RP's) also increased in importance in the mid-1970's. Overnight RP's are highly liquid; funds committed to RP's one day can be used to finance transactions the next day. RP's, however, did not fit into the classification scheme of the old aggregates.

While new assets were appearing, older assets were changing. During most of the 1970's, the average maturity of time deposits at commercial banks and other depository institutions lengthened significantly, due to the establishment of higher interest rate ceilings for longer maturity accounts. This lengthening of maturity, along with substantial interest penalties for early withdrawal of time deposits, made time deposits less liquid than they had previously been, and

CHART 9
Overpredictions of Demand for M1 and M2



Data: See footnote 4.

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less liquid than savings deposits. The rationale for including both time and savings deposits in the monetary aggregates at the same level of aggregation—old-M2 for accounts at commercial banks, old-M3 for accounts at nonbank depository institutions—became strained. (The trend toward lengthening maturities of time deposits was reversed with the authorization of 6-month money market certificates in mid-1978.)

Shift in money demand.—Until the mid-1970's, the demand for money was generally thought to be very stable. At the same time that NOW accounts and like assets began appearing, however, evidence began to suggest that there had been a sudden downward shift in the demand for most of the then-existing monetary aggregates. Demand equations that had worked well until that time began to overpredict the level of money demand; the overpredictions were quite large and showed no tendency to be offset by subsequent underpredictions. Simulation of a demand for money equation illustrates these overpredictions. The equation used in this simulation is of the type popularized by Goldfeld:³

$$M_t/P_t = a + b(\text{GNP72}) - c(\text{RPB}) - d(\text{RCP}) + e(M_{t-1}/P_{t-1})$$

3. Stephen M. Goldfeld, "The Demand for Money Revisited," *Brookings Papers on Economic Activity*, No. 3 (Washington, D.C.: The Brookings Institution, 1973), pp. 683-730.

where:

M/P is real (old-)M1 or (old-)M2 balances,

GNP72 is real GNP,

RPB is the weighted average rate on passbook accounts at commercial banks,

RCP is the average rate on 4- to 6-month commercial paper,

and all variables are measured in natural logarithms.

This equation was fitted to data for 1960:IV-1974:II, and was used to "predict" money demand in 1974:III-1979:IV.⁴ For old-M1, the equation consistently overpredicted demand throughout the period (chart 9). A roughly similar pattern of overpredictions is produced by the simulation of the demand for old-M2, although the errors are considerably smaller, especially during 1976-77.

Although simulations such as these certainly suggest a shift in the demand for money, formal statistical tests of the structural stability of the demand function yield confusing, and sometimes contradictory, results. These findings are illustrated in table 3, which reports the results of two common tests—the F test and the cusum-squares test—for the money demand function given earlier. Before examining these results, however, it is important to be clear that it is not the specification of the demand function that is being tested; it is assumed that the Goldfeld-type equation correctly specifies the demand function. More explicitly, it is assumed that the equation

(1) includes all of the important variables that determine the demand for money,

(2) accurately represents the lag patterns of these variables, and

(3) is correct in treating these variables as additive in their logarithms. If one or more of these assumptions is incorrect, which is a possibility raised by a number of writers, probability statements about whether the demand function has shifted based on

2. For an analysis of factors involved in the growth of these funds, see Timothy Q. Cook and Jeremy G. Duffield, "Money Market Mutual Funds: A Reaction To Government Regulation Or A Lasting Financial Innovation?" *Federal Reserve Bank of Richmond Economic Review* 65 (July/August 1979):15-31.

4. David J. Bennett et al., "Econometric Properties of the Redefined Monetary Aggregates," (Washington, D.C.: Board of Governors of the Federal Reserve System, Division of Research and Statistics, February 1980). (Processed.)

the results in table 8 will be unreliable.⁶

With this caveat in mind, the results in table 8 may be examined. The first four rows of the table show that when variables in the equation are measured in levels, statistically significant structural shifts are found by both tests. Row five of the table shows that when variables are measured in levels but the autocorrelation coefficient is constrained to 0.922, no statistically significant shift is discovered by the custom-squares test. Constraining the autocorrelation coefficient to 0.922 means that the equation is estimated as if the variables were "almost" measured in first differences. (If the autocorrelation coefficient were 1, the results would be identical to estimation of a first-difference specification.) The final three rows of the table show that when variables are measured in true first differences, the F test is unable to detect any structural shift.⁶

Despite the inability of conventional tests to find statistically significant shifts in money demand when the variables are measured in first differences (or "almost" first differences), most researchers and policymakers in the mid-1970's—relying in part on the analysis of prediction errors—had no doubt that a major shift had occurred.⁷ An analysis of the various ex-

6. See, for example, the articles mentioned in R. W. Hafer and Scott E. Hein, "The Shift in Money Demand: What Really Happened?" Federal Reserve Bank of St. Louis Review 64 (February 1982): 11-19. See also, William E. Cullison, "Money, the Monetary Base, and Nominal Income," Federal Reserve Bank of Richmond Economic Review 68 (May/June 1982): 8-13; and Thomas D. Simpson and Richard D. Porter, "Some Issues Involving the Definition and Interpretation of Monetary Aggregates," *Controlling Monetary Aggregates III*, Conference Series, No. 23 (Boston: Federal Reserve Bank of Boston, October 1980), pp. 161-234.

The caveat also applies to the second section's discussion of possible shifts in money demand during 1980-82.

8. For a discussion of the relative ease of finding structural shifts in equations where the variables are measured in levels (and the relative difficulty of finding shifts in equations where the variables are measured in first differences), see Edward K. Offenbacher, "Discussion of Money Demand Papers at Washington University Workshop," in his "Two Papers on Money Demand," Special Studies Paper 157, (Washington, D.C.: Board of Governors of the Federal Reserve System, Division of Research and Statistics, July 1981), p. 5. (Processed.)

7. Evan Hafer and Hein, who point out that no structural shifts are found in first-difference equations, nonetheless conclude that there was indeed a shift in 1974 and that it was the result of a change in the intercept of the money demand equation; they find no evidence of changes in other parameters in the equation. See their "Shift in Money Demand," p. 14.

Table 3.—Tests of Stability of Demand for M1

Specification	Test	Rho constrained to—	Date of break	Test statistic significant at—
Levels.....	t-test	[]	1968:1	Less than 1% level.
Levels.....			1968:1	Less than 1% level.
Levels.....			1974:1	Less than 1% level.
Levels.....	Custom-squares	0.418	n.s.	Less than 1% level.
Levels.....			n.s.	Not significant at 10% level.
First differences.....	F	n.s.	1968:1	Not significant at 10% level.
First differences.....			1968:1	Not significant at 10% level.
First differences.....			1974:1	Not significant at 10% level.

n.s. Not applicable.

1. Rho was unconstrained, assuming different values in each subperiod.

Sources: R. W. Hafer and Scott E. Hein, "Evidence on the Temporal Stability of the Demand for Money Relationship in the United States," Federal Reserve Bank of St. Louis Review 61 (December 1979): 3-14, and by the same authors "The Dynamics and Estimation of Short-Run Money Demand," the same Review 62 (March 1980): 28-35.

Table 4.—Components of the New Monetary Aggregates

Component	M1A	M1B	M2	M3	L
Currency.....	X	X	X	X	X
Demand deposits.....	X	X	X	X	X
Travelers checks of nonbank issuers ¹	X	X	X	X	X
Other checkable deposits.....	X	X	X	X	X
Savings deposits.....			X	X	X
Small denomination time deposits ²			X	X	X
Overnight repurchase agreements.....			X	X	X
Overnight Eurodollar deposits.....			X	X	X
Money market mutual fund shares: ³					
Broker/dealer and general purpose.....			X	X	X
Institutions only.....				X	X
Large denomination time deposits.....				X	X
Term repurchase agreements ⁴				X	X
Term Eurodollar deposits.....					X
U.S. savings bonds.....					X
Short-term Treasury securities.....					X
Bankers' acceptances.....					X
Commercial paper.....					X

1. Travelers checks issued by nonbank institutions were included in the aggregates for the first time in June 1981, when data on them became available. Travelers checks issued by banks had long been included in the aggregates as a part of demand deposits.

2. Includes all retail repurchase agreements.

3. The distinction between broker/dealer and general purpose funds, on the one hand, and institution-only funds, on the other, was made in early 1982. Previously, both had been included in new-M2.

4. Excludes all retail repurchase agreements.

planations for the shift in money demand would lead far afield.⁸ Suffice it to say that because the demand function shifted at about the same time that developments in financial markets were altering the meaning of "money", some analysts concluded that these developments caused (at least part of) the shift in money demand. NOW's, ATS's, and RP's, it was argued, satisfied part of the public's demand for "money" without being represented in the measures of money used in estimating money demand equations. This argument was buttressed by the results of further investigations that showed that the shift in money demand appeared

to be localized in the demand deposit component. The obvious solution was to redefine money so that these new instruments would be included in some way.

The new aggregates

The Board of Governors of the Federal Reserve defined five new aggregates in February 1980. Table 4 shows the components of each aggregate, and these components are defined in the accompanying box.

New-M1A differed from old-M1 only in the treatment of certain foreign-owned demand deposits. In the redefined aggregates, all identifiable monetary assets held by foreign commercial banks and official institutions are excluded on the grounds that the demand for them and their effect on domestic macroeconomic variables are substantially different from monetary

8. For such analyses, see R. W. Hafer and Scott E. Hein, "Evidence on the Temporal Stability of the Demand for Money Relationship in the United States," Federal Reserve Bank of St. Louis Review 61 (December 1979): 3-14 and the references cited there.

Components of the Monetary Aggregates

Currency: legal tender issued by the U.S. Treasury and the Federal Reserve and circulating outside the Treasury and outside the Federal Reserve banks. Currency held in the vaults of commercial banks is counted as part of bank reserves and not as part of the monetary aggregates. Currency held as vault cash by thrift institutions to service their "other checkable deposit" liabilities is also excluded from the currency component of the aggregates. Other currency held by thrifts—assumed to be used in servicing their savings and small time deposits—is removed as a consolidation adjustment from M2.

Travelers checks: outstanding travelers checks of nonbank issuers. (Bank-issued travelers checks are included in the demand deposit component of the aggregates.) Travelers checks were first included in the aggregates in the June 1982 revision of monetary statistics.

Demand deposits: noninterest bearing checking accounts at all commercial banks except accounts owned by domestic banks, the U.S. Government, and foreign banks and official institutions, less cash items in the process of collection and Federal Reserve float. Demand deposits due to commercial banks are excluded to prevent double counting, as are cash items in the process of collection and float. Demand deposits due to the U.S. Government and to foreign banks and official institutions are excluded because their levels are thought to be determined by fundamentally different factors than other demand deposits and to have fundamentally different effects on the economy. Demand deposits held by thrift institutions to service their "other checkable deposit" liabilities are excluded from the demand deposit component. Other demand deposits of thrifts are removed in an M2 consolidation adjustment.

Other checkable deposits: interest-earning checking accounts, including NOW (negotiable order of withdrawal), ATS (automatic transfer from sav-

ings), and super NOW accounts at commercial banks and thrift institutions, credit union share draft accounts, and demand deposits at mutual savings banks.

Overnight repurchase agreements: borrowings by commercial banks from nonbank customers, in which the banks sell securities one day and buy them back the next business day. As with term repurchase agreements (see below), Federal and Federal agency securities are the principal instruments used in overnight repurchase agreements. Most overnight repurchase agreements are believed to be in amounts of \$1 million or more.

Overnight Eurodollars: dollar-denominated, interest-earning deposits maturing the next business day and held by nonbank U.S. residents in Caribbean branches of member banks.

Money market mutual fund shares: interest-earning, checkable deposits in mutual funds that invest in money market instruments. Shares in general purpose funds and broker/dealer funds are included at the M2 level of aggregation; shares in institution-only funds are included at the M3 level.

Savings deposits: interest-earning deposits, which can usually be withdrawn without prior notice without penalty, at all depository institutions. Interest rate restrictions, now determined by the Depository Institutions Deregulation Committee, are scheduled to be eliminated by 1986, as are interest rate restrictions on time deposits. Since December 14, 1982, includes money market deposit accounts which have limited check-writing privileges and which are not subject to regulatory ceilings on interest rates.

Small denomination time deposits: noncheckable interest-earning deposits, which are subject to substantial forfeiture of interest if withdrawn before maturity, in denominations of less than \$100,000 at all depository institutions.

Large denomination time deposits: interest-earning deposits in denominations of \$100,000 or more at all depository institutions, exclusive of the

holdings of domestic depository institutions, money market mutual funds, the U.S. Government, foreign banks, and official institutions. (Holdings of domestic depository institutions and money market mutual funds are excluded to prevent double counting. Holdings of the other institutions are excluded for reasons akin to those for excluding their holdings of demand deposits from the demand deposit component.)

Term repurchase agreements: borrowings by thrift institutions from nonbank customers, in which the borrowers sell securities with the understanding that the securities will be bought back at a specified date. Most term repurchase agreements are in amounts of \$1 million or more, but retail repurchase agreements, in amounts of less than \$100,000, also exist. Retail repurchase agreements are included at the M2 level of aggregation (in small time deposits); larger term repurchase agreements enter the aggregates at the M3 level.

Other Eurodollar deposits: longer-term dollar denominated interest-earning deposits with maturities of more than 1 day held by nonbank U.S. residents in banking offices outside the U.S. Some overnight Eurodollars are included in this component because the available data do not permit their inclusion in the "overnight Eurodollar" component.

Bankers acceptances: negotiable drafts—orders to pay a specific amount at a specified time—that U.S. banks have formally agreed to honor and that are held by the nonbank public exclusive of the amount held by money market mutual funds.

Commercial paper: unsecured short-term debt obligations of corporations held by the nonbank public, net of holdings by money market mutual funds.

U.S. savings bonds: held by the nonbank public, net of holdings by money market mutual funds.

Short-term Treasury securities: marketable securities issued by the U.S. Treasury that have less than 12 months remaining to maturity.

assets owned by other economic units.⁹

New-M1B included other checkable deposits, such as NOW accounts, ATS accounts, and demand deposits at nonbank depository institutions. New-M1B, it was thought, would probably be superior to M1A as a measure of transactions balances. It was appropriate to exclude NOW accounts and other checkable deposits from the narrowest measure of transactions balances because some of these deposits had turnover rates (about 10 per year) intermediate between the turnover rates of demand deposits (35 per year) and ordinary savings accounts (3 per year). Moreover, if, as in fact did happen, NOW accounts were authorized nationwide, M1B might overstate the public's true transactions balances. M1A, which would understate transactions balances in this event, would aid in estimating actual transactions balances by providing a lower bound.

The broader aggregates represent definitions of money that move progressively further away from transactions balances. New-M2 differs considerably from old-M2. (Table 5 shows the relation between the old and new aggregates.) Savings and small time deposits at nonbank depository institutions, as well as at commercial banks, were included in new-M2, along with overnight RP's, overnight Eurodollars, and shares in money market mutual funds. The last three of these items have some of the characteristics of both transactions balances and liquid investments. The Board decided that, on balance, they were more like investments than like transactions balances. Data on each of the series are published by the Board, however, enabling analysts who disagree with the Board's decision to develop alternative measures of their own. (The relative importance of the various components is shown in chart 10.) Large time deposits and term RP's enter the aggregates in new-M3. L, the broadest of the new aggregates, includes a variety of additional assets,

Table 5.—Relation Between New and Old Aggregates

	Old-M1
less	demand deposits of foreign commercial banks and official institutions
equals	New-M1A
plus	other checkable deposits
equals	New-M1B
	Old-M2
plus	savings and time deposits at thrift institutions
equals	Old-M3
plus	overnight repurchase agreements and Eurodollars
plus	money market mutual fund shares
plus	demand deposits at mutual savings banks
less	large-denomination time deposits at all depository institutions in old-M3
less	demand deposits of foreign commercial banks and official institutions
less	consolidation component to eliminate double counting
equals	New-M2
plus	large-denomination time deposits at all depository institutions
plus	term repurchase agreements at commercial banks and savings and loan institutions
equals	New-M3

the largest in a quantitative sense being liquid Treasury obligations.

Aggregation.—The underlying principle of aggregation in the redefined monetary aggregates was that similar kinds of assets should be combined at each level of aggregation. In the old aggregates, the implicit principle had been that similar kinds of assets issued by similar types of institutions should be combined at each level.

The new principle had to be compromised from the outset. An extreme example of compromise is the entry at the M2 level of both money market mutual fund shares and 8-year time deposits. The contrast between the limited check-writing privileges of the former and the substantial interest penalties for early withdrawal of the latter, raises the question whether it would not be useful to have an aggregate broader than M1 but including only highly liquid assets with short maturities. "Clearly, [such] a concept . . . would be an attractive alternative or supplement to present broad money measures, but the statistics on remaining maturity of deposits and other similar assets are not available and would be very costly to collect."¹⁰

The degree to which two assets are similar—the key to the aggregation principle—is reflected in the elasticity

Table 6.—Elasticities of Substitution Between Selected Pairs of Financial Assets

Household sector		
	Currency and household demand deposits	Savings deposits
Savings deposits.....	6.203	
Small time deposits.....	— .070	.162
Business sector		
	Firm demand deposits	Overnight repurchase agreements
Overnight repurchase agreements.....	.645	
Large time deposits.....	.145	.259

Source: David J. Bennett et al., "Econometric Properties of the Redefined Monetary Aggregates," (Washington, D.C.: Board of Governors of the Federal Reserve System, Division of Research and Statistics, February 1980), tables 4-5 and 5-6. (Proceeded.)

of substitution.¹¹ If holders view two assets as excellent substitutes for each other, the elasticity of substitution is very high. Conversely, two assets that complement each other very well will have a large negative elasticity of substitution.

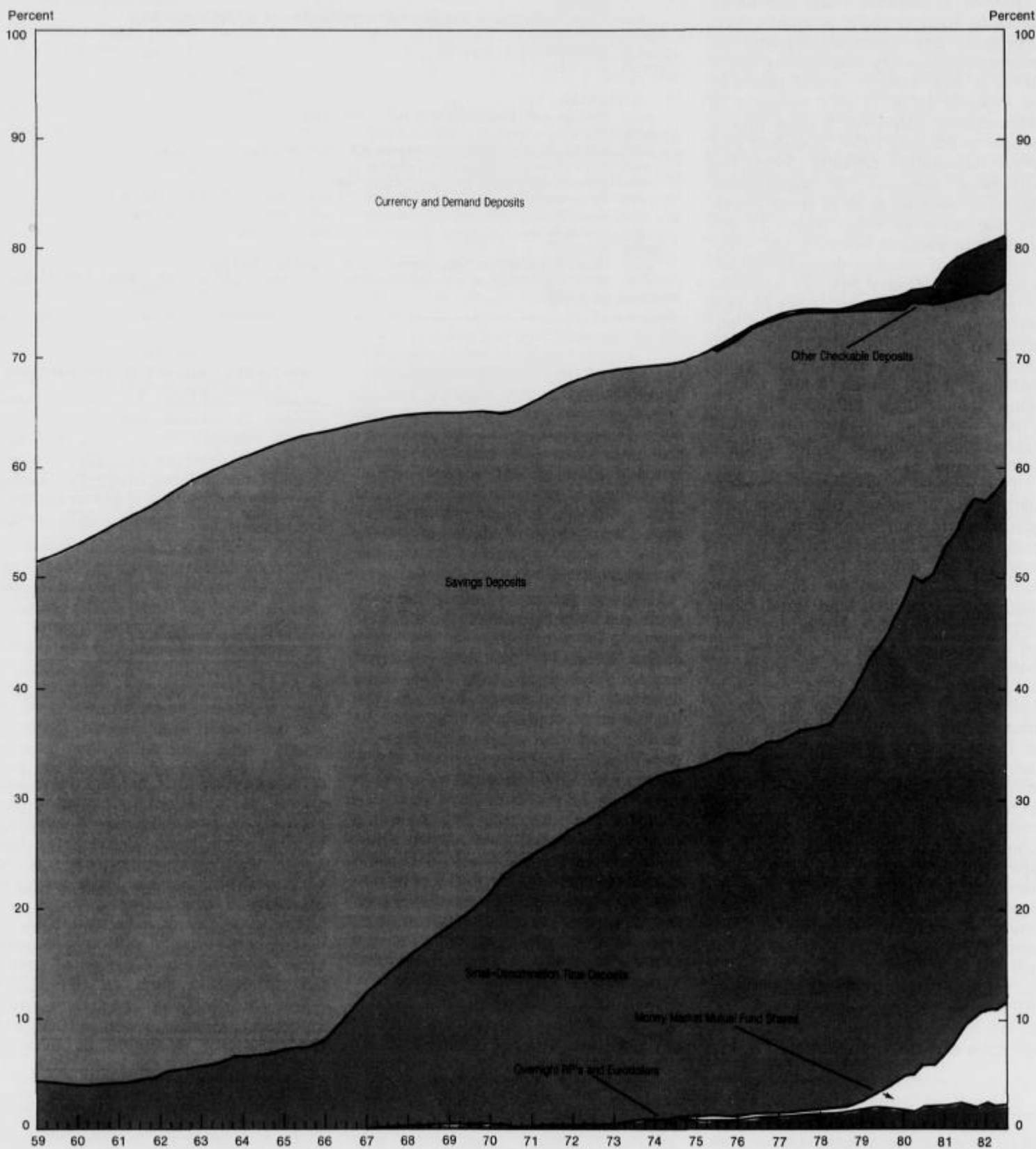
The elasticity of substitution is, of course, exceedingly difficult to estimate, especially in a period of financial innovation such as the 1970's when the elasticity may have been changing. Despite these difficulties, the elasticity estimates in table 6

9. See Helen T. Farr et al., "Foreign Demand Deposits at Commercial Banks in the United States," in *Improving the Monetary Aggregates—Staff Papers* (Washington, D.C.: Board of Governors of the Federal Reserve System, November 1978), pp. 35-54.

10. Stephen H. Axilrod, "Monetary Policy, Money Supply, and the Federal Reserve's Operating Procedures," *Federal Reserve Bulletin* 68 (January 1982):16-17.

11. The elasticity of substitution between assets A and B is measured by the percent change in (A/B) divided by the percent change in (P_B/P_A), where A and B are the amounts of the two assets, in dollars, and P_A and P_B are the (perhaps implicit) yields of assets A and B, respectively.

Components of M2



Data: Federal Reserve Board.

appear reasonable. For households, savings deposits—which are more liquid than time deposits—are closer substitutes for currency and demand deposits than are small denomination time deposits. Time deposits, in fact, appear—on the basis of these estimates—to be complements, rather than substitutes, for the medium of exchange. These estimates taken by themselves, therefore, do not support the practice of having small time deposits and savings accounts enter the aggregates at the same level of aggregation. For businesses, overnight RP's are very good substitutes for demand deposits, and large time deposits are less good substitutes. This finding tends to justify the practice of having RP's enter the aggregates at a lower level (new-M2) than large time deposits (new-M3). One might even argue that the very high elasticity of substitution for RP's suggests that they should enter at an even lower level than new-M2—M1B, say, or some aggregate intermediate between M1B and M2.

Statistical properties.—The redefinition was unsuccessful at removing the apparent shift in money demand in the 1970's. A study prepared at the Board estimated demand equations for each of the old and new aggregates and then used F tests to test the stability of the equations. (Variables were measured in levels.) When the two subperiods 1960:IV-1969:IV and 1970:I-1979:IV were compared, the null hypothesis of stability was rejected at the 5 percent level of significance for every old and new aggregate. When the two subperiods 1960:IV-1974:II and 1974:III-1979:IV were compared, the null hypothesis was rejected for every new and old aggregate except for new-M1A and for the broadest of the old and new aggregates (old-M4, old-M5, and new-L).

Table 7.—Errors From a Dynamic Simulation of Demand Equations for Old and New Monetary Aggregates, 1974:II-1979:IV¹

Aggregate	Mean error	Root mean square error	Aggregate	Mean error	Root mean square error
Old-M1	-34.4	38.1	New-M1A	-35.6	39.2
Old-M2	-48.2	48.1	New-M1B	-31.4	33.7
Old-M3	-71.1	78.4	New-M2	.1	12.6
Old-M4	-115.8	132.1	New-M3	-189.2	221.7
Old-M5	-178.8	214.8	New-L	23.7	50.3

1. Errors are in billions of dollars. All equations were estimated over the period 1960:IV-1974:II. The simulation period for L ends with 1978:III; all other simulations go through 1979:IV.

Source: David J. Bennett et al., "Econometric Properties of the Redefined Monetary Aggregates" (Washington, D.C.: Board of Governors of the Federal Reserve System, Division of Research and Statistics, February 1980), table 2-4. (Processed.)

Redefinition also failed to eliminate the overprediction of the demand for the narrow monetary aggregates after 1974:II (table 7). New M2 and L do predict considerably better than their old counterparts, but the reasons for this are mysterious. Recall that the shift in demand for the old-M's was localized in the demand deposit component. The improved predictive performance of new-M2, then, suggests that overpredictions of demand deposits are offset by underpredictions of other liquid asset components of M2. Further statistical analysis suggests savings and small time deposits as the component most likely to have absorbed funds that otherwise would have gone into demand deposits. Demand functions for this component, however, do not generate underpredictions of the size necessary to offset overpredictions in the demand deposit component. Moreover, new-M3's predictive performance deteriorates markedly in the mid-1970's; this should not happen if savings and small time deposits (or other liquid asset components of new-M2) internalized the shift out of demand deposits.¹²

12. See Bennett et al., "Econometric Properties," pp. 25-28, and Neil G. Barkman, "Abandoning Monetary Aggregates," *Controlling Monetary Aggregates III*, conference Series, No. 23 (Boston: Federal Reserve Bank of Boston, October 1980), p. 88.

Lastly, redefinition had little effect on the performance of the aggregates in reduced-form regressions. As noted in the introduction, it is sometimes suggested that the aggregate most highly correlated with the level of economic activity be chosen as "the" money stock. Moreover, reduced-form regressions are sometimes used to infer the effect that changes in the money stock have on the level of economic activity.

Table 8 shows the standard errors from a typical reduced-form equation of current-dollar GNP on alternative monetary aggregates and a fiscal policy variable; it also shows standard errors for regressions in which constant-dollar GNP, the implicit price deflator for GNP, and the unemployment rate are used as the dependent variables.¹³ These last three regres-

13. Reduced-form regressions of this sort frequently have been criticized because of the possibility of "simultaneous equation bias." This bias results if causation in these equations is not unidirectional—i.e., if there are feedback effects from the dependent variable to one of the independent variables. For an early discussion of this issue, see Frank de Leeuw and John Kalchauer, "Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization—Comment," *Federal Reserve Bank of St. Louis Review* 50 (April 1969): 6-11. A recent investigation concludes that the issue remains unsettled. See, William A. Barnett, Paul A. Spink, and Edward K. Ofenbacher, "Empirical Comparisons of Divisia and Simple Sum Monetary Aggregates," *Conference Paper No. 122*, NBER Conference Paper Series (Cambridge, Mass.: National Bureau of Economic Research, August 1981), p. 29.

Table 8.—Standard Errors From Reduced-Form Regressions

Dependent variable	Monetary aggregate									Maximum	Minimum	Range
	Old-M1	New-M1	Old-M2	Old-M3	New-M2	Old-M4	Old-M5	New-M3	New-L			
Current-dollar GNP	3.848	3.652	4.821	5.933	3.981	4.294	4.169	4.27	3.608	Old-M4	New-L	0.878
Constant-dollar GNP	4.838	4.040	4.079	3.899	8.759	4.555	4.395	4.73	3.689	Old-M4	New-L	.818
Implicit deflator for GNP	1.735	1.804	1.801	1.732	1.761	1.829	1.784	1.20	1.755	Old-M4	Old-M3	.697
Unemployment rate	.411	.415	.424	.396	.397	.431	.424	.28	.411	Old-M4	Old-M3	.635

Notes.—All equations included a fiscal policy variable, defined as the annualized percentage change in high-employment federal expenditures. The monetary and fiscal variables entered the equations with third-degree polynomial distributed lags, constrained to zero at t-5. Sample period: 1970-78.

The aggregates and the dependent variables (except for the unemployment rate) were measured as annualized percentage changes.

Source: Neil G. Barkman, "Abandoning Monetary Aggregates," in *Controlling Monetary Aggregates III*, Conference Series, No. 23 (Boston: Federal Reserve Bank of Boston, October 1980), p. 88.

sions are reported in the belief that real GNP, inflation, and unemployment are the variables of ultimate concern to policymakers.

For each of the dependent variables in table 8, all of the standard errors are relatively large and their range is rather narrow. A pattern is evident, however. Old-M4 produces the largest standard errors for all of the dependent variables, new-L produces the smallest standard errors for both current-dollar and real GNP, and old-M3 yields the smallest standard errors for inflation and unemployment.¹⁴ (New-L, it may be noted, is perhaps least amenable to control by the monetary authorities of all the old and new aggregates.)

Of the other new aggregates, new-M1 produces the smallest standard error for current-dollar GNP and new-M2 produces the smallest standard errors for the other dependent variables. In no instances are these standard errors much, if any, smaller than the standard errors produced by some of the old aggregates. Redefining the aggregates, therefore, had little effect on their performance in reduced-form equations estimated with data for the 1960's and 1970's. It may well be, of course, that the new aggregates would outperform the old aggregates subsequent to 1979.

Developments in 1980-82

During 1980-82, some of the innovations of the preceding decade assumed new importance; in addition, new financial instruments and services made their appearance. In this section, these developments are described and then the growth of the aggregates and the stability of money demand during the past few years is discussed.

Innovations in financial markets

The Depository Institutions Deregulation and Monetary Control Act of 1980 authorized the nationwide issuance of NOW accounts, effective December 31, 1980. In the first two months of 1981, "other checkable deposits"—in which NOW's are included—roughly doubled, rising \$26½ billion, as funds flowed into NOW accounts from demand deposits and from savings accounts. Over the entire year, other checkable deposits increased \$60 billion, while demand deposits fell \$31 billion (11½ percent).

Not all of the increase in other checkable deposits was at the expense of demand deposits. There were two important reasons for assuming, early in 1981, that a sizable part of the increase in NOW accounts would actually serve as savings, rather than transactions, balances. First, many depository institutions required relatively large minimum balances in NOW accounts; it was reasonable to assume that individuals would cover at least part of this requirement by shifting funds out of savings balances. Second, the experience with NOW accounts in New England had been that roughly one-third of flows into NOW accounts and ATS accounts had represented shifts of funds out of savings balances and other non-M1 sources.

The Federal Reserve estimated that 22½ percent of the flows into newly opened NOW accounts in January 1981, and 27½ percent in February-December, came from non-M1 sources. This amount was subtracted from M1B in order to obtain "shift-adjusted M1B," which was then used as the basic measure of transactions balances.¹⁵ Shift-adjusted M1B was the focus of most monetary policy discussions in 1981. By the end of 1981, the shift into M1 attributable to NOW accounts was concluded to have run its course. The shift adjustment was discontinued as of January 1982, M1A was dropped from the list of aggregates, and M1B was rechristened M1.

Several new assets have appeared since early 1980. Effective October 1, 1981, All Savers Certificates were authorized, with 12-month maturities and limited tax exemption of interest earnings. In the spring of 1982, 91-day certificates of deposit—with yields tied to those on Treasury bills—were introduced at depository institutions. Beginning May 1982, depository institutions were authorized to offer negotiable and nonnegotiable certificates of deposit with maturities of 3½ years or more, with no restrictions on their yields. Effective September 1982, depository institutions were permitted to offer certificates with maturities of from 7 to 31 days with yields linked to Treasury securities. Presumably all of these certificates compete mainly with other short-term liquid assets—money market mutual fund shares, retail repurchase agreements, and other certificates of deposit—already included in M2. If so, the level and rates of change of the broad aggregates will be little affected, although the composition of M2 could change.

Two points should be noted about these new instruments. First, they represent a continuation of the movement toward the deregulation of the yields on time deposits at depository institutions. (All deposit rate ceilings are scheduled to be eliminated by 1986 in accordance with the provisions of the Depository Institutions Act.) In early 1978, less than 5 percent of the non-M1 components of M2 bore market-related yields; by early 1982, this share had risen to over 64 percent.¹⁶ The sensitivity of M2 with respect to changes in market interest rates, therefore, has decreased substantially. This decreased sensitivity is well illustrated by M2 growth in 1981. Interest rates were high throughout the year, but especially during the summer. The rate on 3-month Treasury bills, for example, rose from 13.6 percent in April to an average of 15.2 percent for May

14. A comparison of the standard errors produced by the various aggregates should be understood as suggestive rather than conclusive. The comparisons would be strictly legitimate only if the estimated coefficients of autocorrelation in each regression were identical. Although the source for table 8 does not report these coefficients, it is highly unlikely that this condition is met.

15. An explanation of the method of calculating shift-adjusted M1B is given in Daniel L. Thornton, "The FOMC in 1981: Monetary Control in a Changing Financial Environment," Federal Reserve Bank of St. Louis Review 64 (April 1982): 4.

16. David E. Lindsey, "Recent Monetary Developments and Controversies," *Brookings Papers on Economic Activity*, No. 1 (Washington, D.C.: The Brookings Institution, 1982), p. 252.

through September. In earlier years, such rates would have led to large movements of funds out of low yielding M2-deposits and into market instruments. In 1981, however, the non-M1 components of M2 increased at an 11 percent annual rate from April to September, the same rate as in the previous five months (when rates had averaged 75 basis points lower) and much faster than M1 itself (which actually decreased at a 1 percent annual rate).

Second, the quantitatively most significant certificates of deposit are 6-month money market certificates (MMC's). The popularity of MMC's has shortened the average maturity of time deposits, making time deposits more liquid and, therefore, better substitutes for transactions balances. Some of the other certificates are tending to have the opposite effect, however. In particular, funds in individual retirement accounts and Keogh Plan accounts are quite illiquid, given the tax penalties that attach to premature withdrawal.

Deposit "sweeping" arrangements have spread in recent years. Such arrangements provide that when transactions balances rise above a specified level, the excess funds are to be invested in short-term, highly liquid assets bearing market-determined rates of return. (The sweeping may, depending on the terms of the agreement, be done by the customer or automatically by the bank.) Conversely, when transactions balances fall below a specified level, liquid assets are to be sold and the proceeds put into the transactions account.

Deposit sweeping is presently of importance primarily to large companies although the practice is now being used by increasing numbers of medium-sized and small businesses. Deposit sweeping is also a characteristic of many cash management accounts offered to individuals by brokerage firms, and some depository institutions have begun to offer the service to retail customers.

The president of the Federal Reserve Bank of Boston has suggested that if deposit sweeping continues to spread, it will have serious implications for the measurement and interpretation of the monetary aggregates.

Funds in sweep accounts are clearly transactions balances from the point of view of the owners of the accounts; the funds are available for spending each morning. By close of business, however, a substantial portion of transactions balances may have been swept. Because the monetary aggregates are measured on the basis of balances at the close of business, they underestimate the volume of transactions balances. If the prevalence of deposit sweeping spreads, the seriousness of this underestimation will increase.

The principal reason for holding funds in a sweep account, of course, is to earn interest on transactions balances. This reason has been undercut by recent actions of the Depository Institutions Deregulation Committee. Effective December 14, 1982, depository institutions were authorized to offer money market deposit accounts. Effective January 5, 1983, depository institutions were authorized to offer "super NOW accounts." Money market deposit accounts carry limited check-writing privileges (three per month), while super NOW accounts are true transactions accounts. The minimum balance for both types of account is \$2,500 and both are free of restrictions on interest rates that may be paid. The authorization of these two new accounts substantially reduces the incentive for individuals to hold sweep accounts. Corporations, which are not now permitted to own super NOW accounts, continue to have an incentive to hold sweep accounts. The Depository Institutions Deregulation Committee, however, is currently considering a proposal to permit corporate accounts like super NOW's. If such an account is authorized, corporations too may have little reason to use sweep accounts.

The Garn-St Germain Depository Institutions Act of 1982—which has been called the most important legislation for financial institutions in 50 years—required the Depository Institutions Deregulation Committee to

authorize an account that would be directly competitive with money market mutual funds. The money market deposit account was the committee's response to this directive.

It is generally expected that money market deposit accounts will offer yields somewhat higher than those offered by the money market mutual funds, at least initially, in order to attract deposits. Depository institutions may be able to afford to offer a higher rate because they can invest in longer term, higher yielding assets than the money market funds can. ("Borrowing short and lending long," of course, would expose the institutions to possibly severe earnings pressures if the term structure of interest rates were to turn negative.) Nonrate considerations may also favor the depository institutions—the availability of Federal deposit insurance, for example, and the convenience of dealing with a local institution instead of one located in a distant city. Competition between depository institutions and money market mutual funds, of course, can be expected to affect primarily the composition of M2 rather than its level. There could well be some spillover effects, however, in which funds invested in, say, Treasury bills, would be drawn into M2, raising its level.

Money market deposit accounts, it is important to note, continue the trend mentioned earlier toward reducing the interest rate sensitivity of the M2 total. With rates completely free of ceilings, it is much less likely that funds will flow out of depository institutions when market interest rates rise. The coefficient of interest rates in demand for M2 equations, therefore, can be expected to fall.

Similarly the coefficient of interest rates in demand for M1 equations can be expected to fall now that transactions balances free of interest rate ceilings are available. Also, it is clearly possible that some inflows into super NOW accounts will draw funds from assets that are not included in M1, so that both the composition of M1, its level, and the composition of the broader aggregates will be affected.

Monetary growth in 1980-82.—The Federal Open Market Committee sets fourth-quarter to fourth-quarter

17. Frank E. Morris, "Do the Monetary Aggregates Have a Future as Targets of Federal Reserve Policy?" *New England Economic Review* (March/April, 1982) 5-14.

target ranges for the growth rates of M1, M2, and M3. (The committee also sets a target range for the growth rate of bank credit, which this article will ignore. No target is set for L.) The growth rate targets for the M's are shown in the left-hand panels of chart 11, along with the actual rates of growth of the M's from November

of the preceding year.¹⁸ The levels of the aggregates are shown in the right-hand panels, along with the range of levels implicit in each growth rate target. This chart illustrates two of

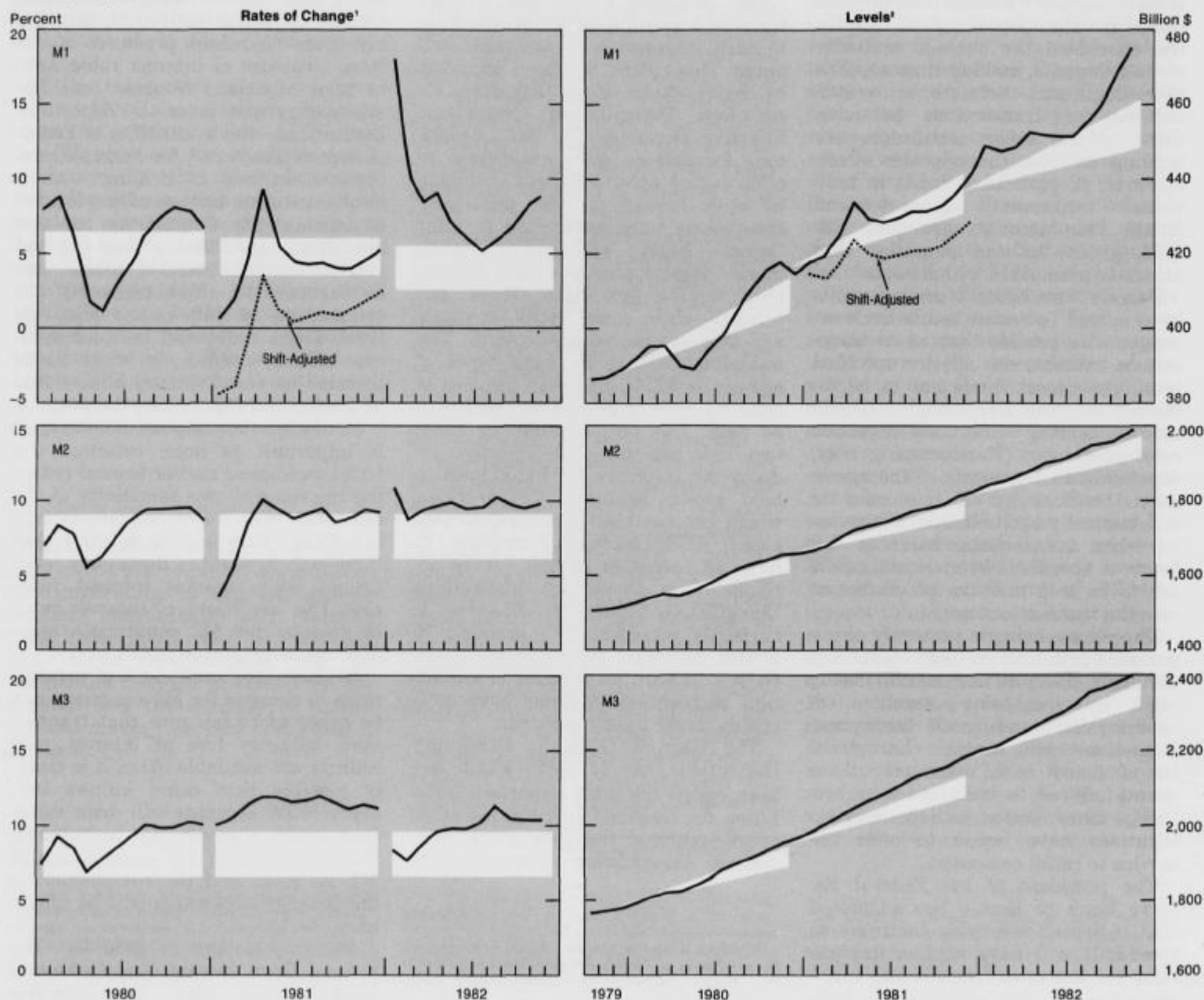
18. The chart would not be changed much if the fourth-quarter average levels of the M's, instead of the November levels, were used as the bases for calculating the rates of growth.

the most important issues relating to monetary growth in the past few years.

First, short-term variations in growth rates of the aggregates have been quite substantial. M1 growth has exhibited the largest such variation, but the broader aggregates have also exhibited large swings. Hein esti-

CHART 11

M1, M2, and M3



1. White areas show growth rate ranges established by the Federal Open Market Committee. Lines show actual percentage changes (at seasonally adjusted annual rates) from November of preceding year.

2. White areas show levels implicit in ranges established by the Federal Open Market Committee. Lines show actual levels.

Data: Federal Reserve Board.

mates that M1 growth—measured as deviation from trend—was more volatile in the second and third quarters of 1980 than at any other time in at least 20 years.¹⁹ Some have interpreted this volatility as indicative of shifts in the demand for money and have concluded that, because money demand cannot be forecast reliably, the use of aggregates as intermediate targets of monetary policy should be abandoned. Others contend that the volatility is better explained by developments affecting the supply of money—developments such as the credit control program in the spring of 1980 and the change in the Federal Reserve's operating procedure in the fall of 1979. If this latter interpretation is correct, the Federal Reserve need only abandon those practices that caused the volatility.

The second issue illustrated in chart 11 is the divergent behavior of the various aggregates—divergent behavior that complicates the tasks of formulating and analyzing monetary policy. In 1981, for example, shift-adjusted M1 increased along a path that was below the lower limit of the range set by the Committee. M2 and M3, in contrast, increased along a path that was at or above the upper limit. Was money very tight, as suggested by the shift-adjusted M1 path, or was it not so tight, as suggested by paths of the broader aggregates? Further, although shift-adjusted M1 was well short of its targeted growth path during most of 1981, unadjusted M1 was comfortably within that range.²⁰ If M1, rather than shift-adjusted M1, was a better measure of transactions balances in 1981, then the discrepancy between the growth rates of transactions balances and the broader aggregates is reduced substantially.

Short-term growth rate variations in 1981 are also related to the shift-adjustment issue. If the shift-adjusted measure of M1 is used, growth fell from 11.1 percent in the fourth quar-

ter of 1980 to -0.9 percent in the first quarter of 1981; if the unadjusted measure is used, growth fell from 11.1 percent in the fourth quarter of 1980 to 4.6 percent in the first quarter of 1981.

As explained earlier, the shift adjustment was an estimate of the amount of the increase in other checkable deposits that came from sources other than demand deposits. One interpretation of the adjustment is that such funds would be idle balances and that they would have to be netted out of M1 to obtain an accurate measure of transactions balances. In calculating the shift adjustment, the staff of the Federal Reserve Board relied on surveys of depository institutions, surveys of households, and cross-sectional econometric analysis of changes in demand deposits and changes in other checkable deposits.

Some critics have concluded that the shift adjustment thus calculated was much too large. They maintain that unadjusted M1 was a better measure of transactions balance in 1981 than shift-adjusted M1.²¹ Using the unadjusted measure, the increase in velocity of M1 in 1981 is much less than the increase calculated using adjusted M1. The demand for M1, there-

fore, appears to be more stable if the shift adjustment is ignored.

Defenders of the shift adjustment explain the velocity behavior of adjusted and unadjusted M1 by hypothesizing a downward shift in money demand—a shift about equal in size, but otherwise unrelated, to the shift adjustment. Lindsey, for example, suggests that the increased use of money market fund shares for transactions purposes, the economizing on transactions balances induced by the high yield and liquidity of money market funds, and the further spread of improved cash management practices all are important for an understanding of 1981's velocity behavior. Many other analysts and policy-makers have also hypothesized recent shifts in money demand.²²

To examine the possibility of a recent shift, a Goldfeld-type demand equation was estimated in both level and first-difference forms for 1959:III–1979:IV. (This equation was identical to the one discussed earlier except that the average rate on time deposits

21. See, for example, John A. Tatom, "Recent Financial Innovations: Have They Distorted the Meaning of M1?" Federal Reserve Bank of St. Louis Review 64 (April 1982): 23–35, and Cullison, "Money, the Monetary Base, and Nominal Income," p. 6.

22. Lindsey, "Recent Monetary Developments and Controversies," p. 250. See also Axilrod, "Monetary Policy," p. 18 *passim*; William C. Ford, "Monetary Policy in 1981–1982," *Economic Policy Issues Conference Board Report*, No. 1 (New York: The Conference Board, 1982), p. 4; John Wenniger, Lawrence Radecki, and Elizabeth Hammond, "Recent Instability in the Demand for Money," Federal Reserve Bank of New York Quarterly Review (Summer 1981), pp. 1–9; and Byron Higgins and Jan Faust, "Velocity Behavior of the New Monetary Aggregates," *Economic Review of the Federal Reserve Bank of Kansas City* (September–October 1981), pp. 3–7.

Table 2.—Regressions for M1/P, Various Periods¹

	1959:III– 1979:IV	Not adjusted		Shift-adjusted	
		1980:I– 1982:I	1980:II– 1982:I	1980:I– 1981:IV	1980:II– 1981:IV
Coefficients:					
Constant	0 (.49)	-0.018 (8.99)	0 (.07)	-0.012 (1.50)	0 (.28)
GNP	.217 (2.97)	.070 (.47)	.246 (2.99)	-.073 (.24)	.268 (3.21)
RTD	-.041 (1.80)	.030 (.12)	-.085 (4.65)	-.077 (1.22)	-.099 (5.69)
ACP	-.012 (1.90)	.076 (4.76)	.004 (.60)	.068 (2.97)	.002 (.35)
(M1/P) _{t-1}	.502 (4.89)	-1.357 (3.67)	.285 (2.65)	-.403 (.99)	.361 (3.70)
D	-.012 (2.06)	(?)	-.015 (2.18)	(?)	-.014 (2.15)
R ²	.447	.372	.351	.388	.438
S.E.E.	.0064	.0053	.0058	.0068	.0065
D-W	2.04	1.27	1.50	1.62	2.00

1. All variables, except D, are in first differences. Figures in parentheses are *t*-statistics.

2. D has a value of zero throughout this subperiod and, therefore, cannot be included in the regression.

19. Scott E. Hein, "Short-Run Money Growth Volatility: Evidence of Misbehaving Money Demand?" Federal Reserve Bank of St. Louis Review 64 (June/July 1982): 28.

20. The Committee did not establish a growth rate range for unadjusted M1 in 1981. The Committee did, however, anticipate (accurately, as it turned out) that unadjusted M1 growth would be about 2½ percentage points higher than the growth rate of shift-adjusted M1.

was substituted for the average rate on passbook accounts.) Both forms were then used to make static simulations of money demand in 1980:I-1982:I. In each case, the root mean square error of the simulation was more than triple the standard error of estimate of the associated regression, lending support to the suggestion that there has been at least one shift in the demand for M1 since 1979.

In a more formal analysis, the first-difference form of the equation was estimated for 1959:III-1982:I and an F test was performed to test for a shift in the first quarter of 1980. (For 1981, both shift-adjusted and unadjusted M1 were used.) The results are striking (table 9). The coefficients for the 1980:I-1982:I period bear no resemblance to those of the earlier period. The F-statistic (distributed with 6 and 79 degrees of freedom) was 9.44 for unadjusted M1 and 5.98 for shift-adjusted M1, both far above the critical level (3.07) for the 1-percent level of significance; the null hypothesis (stable money demand) is rejected. The high F-statistics in these tests are the more remarkable when it is recalled that the F test is frequently not

powerful enough to identify shifts in first-difference equations.

The post-1979 instability in money demand differs importantly from the 1974 shift, which led to large and consistent overprediction of the demand for money. Since 1979, there have been large overestimates for some quarters, but there have also been large underestimates for some others. The bias in the estimates is quite small. The fact that over- and underestimates have tended to cancel each other out may be viewed as justifying the aggregates as intermediate targets of monetary policy. The recent instability may be viewed as indicating the futility of using monetary policy to "fine-tune" the economy from quarter to quarter, but it may be compatible with the possibility of "gross-tuning" from year to year, say, or from cycle to cycle.

Another way to justify the role of the monetary aggregates, of course, is to deny that even the quarterly volatility in monetary growth since 1979 has been due to shifts in money demand and to argue that it has been due to supply side disturbances. Those who have taken this tack point to the

credit control program that the Federal Reserve Board administered in the spring of 1980 and to the change in the Federal Open Market Committee's operating procedures in the fall of 1979.²³ If, as has been argued, these developments created an imbalance between the amount of money demanded and the amount supplied, then the F tests reported above are invalid. Detailed examination of this issue would entail an investigation of monetary control, which is outside the scope of this article. Without such an investigation, about all that can be said—unsatisfying though it may be—is that the question of monetary stability since 1979 is still open.

23. See, for example, Hein, "Short-Run Money Growth Volatility," and the references cited therein, and Allen H. Meltzer, "The Results of the Fed's Failed Experiment," *Wall Street Journal*, July 29, 1982, editorial page. Meltzer does not explicitly rule out the possibility of a shift in demand but does say that since "the experiment began in October 1979, the volatility of money growth . . . has been raised . . . more than necessary."

Note that the credit control program can be viewed as affecting not the supply of money, but rather the demand for money. See, *The New Monetary Control Procedures—Federal Reserve Staff Study* (Washington, D.C.: Board of Governors of the Federal Reserve System, 1981).